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# Yoga Posture Detection and Correction Using YOLOv8

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***Abstract: This paper presents a novel approach to real- time yoga posture detection and correction using the YOLOv8 objectdetectionalgorithm.Thesystemaimsto assist practitioners in performing yoga poses correctly, thereby reducing the risk of injuries and enhancing the effectiveness of their practice. The system works by analyzinglivevideo feedsofpractitionersandcomparing theirposestoadatabaseofcorrectposes.Ifdiscrepancies are detected, real-time feedbackis provided to guide the practitioner in adjusting their posture. The system also tracksthepractitioner's progressovertime, allowing for personalized feedback and recommendations. Experimentalresultsdemonstratetheeffectivenessofthe system in accurately detecting and correcting yoga postures, highlighting its potential to revolutionize the way yoga is practiced and taught.***
***Keywords: Yogaposturedetection,Yogaposturecorrection, YOLVOv8, Image processing, CVAT annotation.***

## I. INTRODUCTION

Yoga is a holistic practice that combines physical postures, breathing techniques, and meditation to promote physical, mental,andemotionalwell-being.However,practicingyoga incorrectly can lead to injuries and negate its benefits. To address this issue, researchers and developers are exploring innovative solutions to assist practitioners in performing yogaposesaccurately.Onesuchsolutionisthedevelopment of a real-time [1] yoga posture detection and correction system using YOLOv8, an advanced object detection algorithm. YOLOv8, short for [3] "You Only Look Once version 8," is renowned for its speed and accuracy in detecting objects in images and videos, making it an ideal candidate for this application.

The system works by first capturing live video of a person performing yoga poses. This video feed is then processed using YOLOv8 to [5] detect key points on the practitioner's body, suchasjointsandbodysegments,whicharecrucialfor determiningthe correctnessofthepose.Thesekeypointsare used to analyze thealignmentand orientation of thebody in real-time. Once the key points are [7] detected, the system compares them against a database of correct yoga poses. If any discrepancies are found, the system provides real-time feedback to the practitioner, highlighting areas where adjustments are needed to achieve the correct posture. This feedback can be in the form of visual cues overlaid on the video feed or audio instructions to guide the practitioner.

Overall, the use of YOLOv8 for yoga posture detection and correctionhasthepotentialto[8]revolutionizethewayyoga ispracticedandtaught.Byprovidingreal-timefeedbackand guidance,thistechnologycanhelp practitioners ofall levels improve their practice, prevent injuries, and deepen their understanding of yoga principles. Theproblemstatementforthereal-timeyogaposturedetection and correction system using [4] YOLOv8 is to address the challenges faced by practitioners in performing yoga poses correctly. Current methods rely on visual observation and verbal cues, which may not always be accurate or timely.

The proposed system aims to provide real-time feedback to practitioners, helping them improve their posture alignment and maximize the benefits of their practice. By leveraging [2] speed and accuracy of YOLOv8, the system has the potential to revolutionize the wayyogais practicedandtaught,making it more accessible and beneficial for practitioners of all levels. Additionally, we renowned the limitations encountered in the course of our studies, also covering the way for future investigations

## II. LITERATURE SURVEY

Neha D, etal [1] presented a paper on an innovative method ofprovidingindividualizedexerciseadvicethatisofferedby the combination of Python, OpenCV, and Media Pipe in an AI fitness trainer. By means of their investigation, scholars showcased the proficient application of computer vision methodologies for instantaneous tracking of movements, providing consumers with prompt input about form and approach. The use of Media Pipe in the processing of video data improves movement analysis's precision and effectiveness even further. Furthermore, the integration of machine learning algorithms allows the delivery of personalized exercise advice and progress monitoring, therefore cultivating an intensely participatory and captivating user experience. This creative combination of technology shows how AI-powered personal trainers may completely transform people's training journeys.

The work makesasubstantialcontributiontothechangingfieldofAI- driven fitness solutions by demonstrating the useful implications and developments in tailored health and wellness applications.[1]

Gajbhiye,etal[2]presentedapaperontheincreasingglobalsignificanceofyogaanditswell-establishedhealthbenefits.In spiteofthis,thereare stillalotofobstacles facingyoga, such as theunderuse of computer vision technology in the fitness and health sectors. By outlining many posture estimationalgorithmsandhowtheymaybeusedinAndroid applications for yoga, this white paper closes a significant gap. The methods presented here show how to estimate a posture systematically by using convolutional neural networks (CNNs) to identify the poses of the human body. For precise position estimation, the suggested method presents a potential approach by recognizing trained joints and limbs.Allthingsconsidered,thisstudy offers insightful information on how computer vision techniques might be incorporated into yoga practice, opening the door to improved posture assessment and digital age workout recommendations.[2]

AnushaS,etal[3]presentedastudyonhowvirtualassistants are becoming more andmoreintegrated intoourdaily lives, leadingtoourdependenceonthemforavarietyofactivities. This research explores the rapidly developing subject of computervisionwiththegoalofcreatingaworkoutprogram that is easy to use. The main goal of the project is to use OpenCV to develop a useful, stand-alone training regimen thatcandirectusersthroughexercisesandrecommendideal postures.Enablinghands-freeengagementisaprimarygoal, allowingsmoothworkoutswithoutrequiringadditionalinput devices. By achieving these objectives, the research offers fresh perspectives on the possibilities of AI-driven fitness solutions and advances the integration of computer vision technologies in encouraging physical activity and well- being.[3]

Kotte, etal [4] presented the study which emphasizes the issues in psychomotor skill development by introducing a novel approach that uses computer vision for real-time posture feedback in fitness training. With the use of human topology-orientedmonitoringandtheYOLOv7-posemodel, the system allows for immediate self-correction and incentive. Specifically,transferlearning methodsreduce the need for model retraining and increase productivity. The studyshowsthesystem'sperformanceanduserhappinessby benchmarking against expert fitness videos and user assessments with novice participants. Positive responses emphasize the method's promising usability and point to possibleimprovements in userinterface design.Overall, the research offers fresh approaches to boost trainees' performance and growth while providing important insights intousingcomputervisiontoimprovemotorskillacquisition in fitness training.[4]

Githinji, etal [5] presented a paper which offers a timely response to the COVID-19 pandemic-related spike in demandforno-contactexerciseguidelines.Thestudytackles the shortcomings ofcurrentonline fitnessinstruction videos bysuggestinganAIFitnessCoachsystemthatprovidesreal- time feedback throughout exercises. The system, which consists of feedback units, fitness movement analysis, and pose identification, allows users to get audio or video instruction based on postures that have been taken. The suggested strategy shows encouraging outcomes that are on par with current methods, proving that it is effective in assisting withat-homeworkoutregimens.By improving the area of AI-driven fitness monitoring systems, our research helps those who don't have access to a gym but yet want tailored and interactive workout assistance.[5]

Bhosale, etal [6] presented a literature review which examines an important use of computer vision to improve yoga practice by identifying and correcting incorrect postures is presented in the abstract. Through PoseNet and KNNclassifier-basedposecategorization,theworkseeksto encourage safer and more successful yoga sessions by acknowledging the possible dangers associated with wrong poses. The OpenPose library and deep learning algorithms are used by the system to provide users with real-time feedback and directions on how to do yoga poses correctly. Byprovidingpeoplewiththetoolstopreserveidealformand avoid injuries when practicing yoga at home, this research advancestheareaofyogaposturerecognitionandcorrection. All things considered, the suggested approach has potential to encourage healthier lives by providing clear and precise instructions for yoga poses.[6]

Thoutam,etal[7]providedthestudywhichoffersathorough synopsisoftheimportanceofyogain contemporary livesas wellasthepossiblehazardsconnectedtoimproperposes.In response to the increasing popularity of self-learning yoga, the study presents a deep learning-based method for identifying and rectifying incorrect yoga postures. The technologyusestrainedmodelstodetectimproperanglesand offers real-time feedback for pose development by letting userssubmitrecordingsoftheiryogapractice.Thesuggested technique's remarkable precision and efficiency, with an impressive accuracy of 0.9958, are demonstrated through comparison with cutting-edge techniques. By providing people with the tools to avoid injuries and keep their health at its best while pursuing their wellness objectives, this research considerably advances the safety and efficacy of self-guided yoga practice.[7]

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The research presents the LGDeep model, a revolutionary method that integrates deep learning architectures such as Xception, VGGNet, and SqueezeNet with residual convolutional neural networks. To improve classification accuracy, the model also includes feature extraction techniques like LDA and GDA. The results of the experiments suggest that the LGDeep classifier ismoreeffectivethanothertechniquesat correctlycategorizingyogapositions.Allthingsconsidered, thisresearchoffersinsightfulinformationondevelopingAI- driven methods for boosting general health and wellness results and yoga practice.[8]

Kishore, etal [9] delivered the study that delves into the increase in yoga practitioners during the recent pandemic, many of whom lacked appropriate direction. It comes at a critical moment. Through precise posture estimation, the studyseekstoreducetheworkrequiredofpractitioners.Four distinct deep learning architectures were put into use and trained with pictures taken from a real database including regularyogaposes.ThestudydeterminesthattheMediaPipe architecture provides the maximum estimated accuracy throughcomparisonanalysis.Usingcutting-edgetechnology to give real-time position estimates, this research enhances the usability and efficacy of yoga practice. The study guaranteesthevalidityandsuitabilityofthesuggestedmodel in practical contexts by employing genuine training data, helping practitioners achieve proper alignment of their postures and optimize the advantages of their yoga practice.[9]

## III. ABOUT DATASET

The process of building a dataset for key point-based yoga postureidentificationandcorrectionentailsgatheringphotos of individuals doing different yoga poses and labeling them with key points that correspond to important joints or body components:

### *1) Image Collection:*

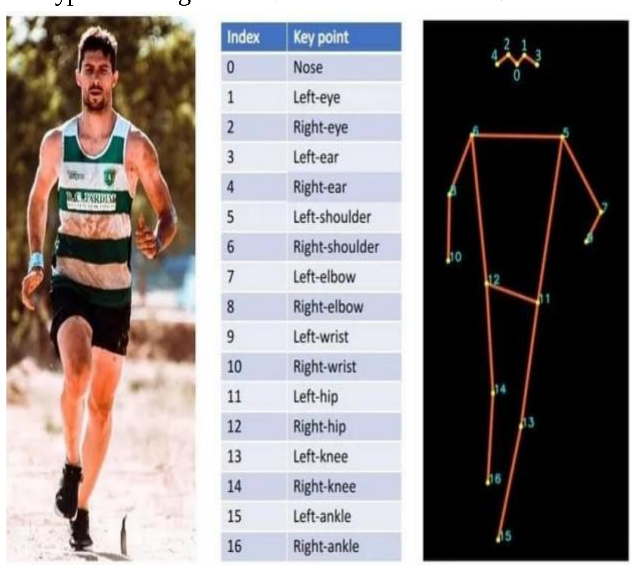
Collect a variety of images showing people in various yoga positions. In a variety of settings, including parks, residences,andyogaclasses.weusecamerasorcellphones to take these pictures. For accurate key point identification and annotation, make sure that the images have sufficient light and no background clutter. Here, for this yoga posture (using key points) detection and correction using yolo v8 system We collected 100 images for each pose.

### *2) Annotation Process:*

Mark important joints or body components associated with each yoga position with key point annotations. The locations of the wrists, elbows, shoulders, hips, knees, and ankles are examples ofcommon key points.

Mark theimportantspotsoneach imagebymanually using annotation tools or software. Make that the key points are annotated accurately and consistently across the dataset.Here for this yoga posture (using key points) detection and correction using yolo v8 system annotate the images with key points representing key joints or body parts which is shown in following figure.

Wemanuallyannotateeachimagewiththekeypointsusing the "CVAT" annotation tool.



| Index | Key point |
|---|---|
| 0 | Nose |
| 1 | Left-eye |
| 2 | Right-eye |
| 3 | Left-ear |
| 4 | Right-ear |
| 5 | Left-shoulder |
| 6 | Right-shoulder |
| 7 | Left-elbow |
| 8 | Right-elbow |
| 9 | Left-wrist |
| 10 | Right-wrist |
| 11 | Left-hip |
| 12 | Right-hip |
| 13 | Left-knee |
| 14 | Right-knee |
| 15 | Left-ankle |
| 16 | Right-ankle |

Fig1:Key Points Representing Key Joints or Body Parts

CVAT stands for Computer Vision Annotation Tool. It is a free, open-source digital image animation tool.

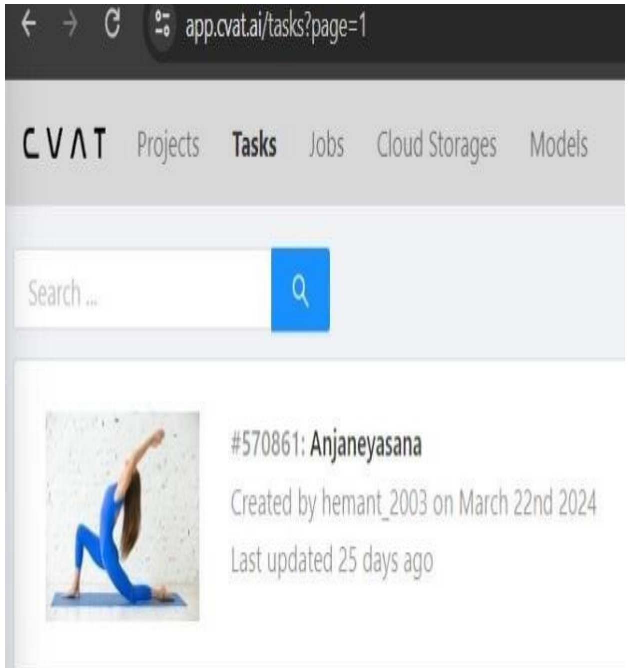



Fig2:"CVAT" Annotation Tool

*3) Keypoint Representation:*

Establish a uniform structure for the annotated key points' representation. The coordinates (x, y) for each key point should match its location inside the picture or frame.

To show how reliable a key point's detection is, give it a confidence score. In the course of training, this can assist in removing erroneous or noisy key points.

*4) Guidelines forLabeling:*

To guarantee that various annotators are consistently annotating the key points, clearly define the labeling rules. Give guidance and examples on how to precisely and thoroughly annotate essential topics. Using the locations of thehighlightedkey pointsasaguide,definethestandardsfor judging a yoga posture to be correct.

*5) Splitting Data:*

Separate the annotated dataset into validation and training sets.70–80%ofthedatasetcomprisesthetrainingset,which is used to train the YOLOv8 model on a variety of yoga positions and variants.The validationset is made upof 10–20% of the dataset, this set is used to track training progress and adjust model parameters while it is being trained.

## IV. METHODOLOGY

Modern object identification algorithms like YOLOv8 are renowned for their quickness and precision. It works by creating a grid out of the input image and using that grid to forecast bounding boxes and class probabilities. Thanks to advancementsindesignandtrainingmethods,YOLOv8has developed from earlier iterations, such as YOLOv3, and is now appropriate for real-time object identification applications.

Data for Training: Creating a unique dataset designed for yogaposturerecognitionandcorrectionistheproject'smain task.Thisdataset consistsofannotatedpicturesorvideos of several yoga positions. Key joints that are pertinent to the postures are represented by landmarks or key points. Key point annotation of the dataset allows accurate posture correctnessanalysisandmakescorrectivefeedbackeasierto provide during inference.

### *A. Flow of Yoga Posture Detection and Correction System:*

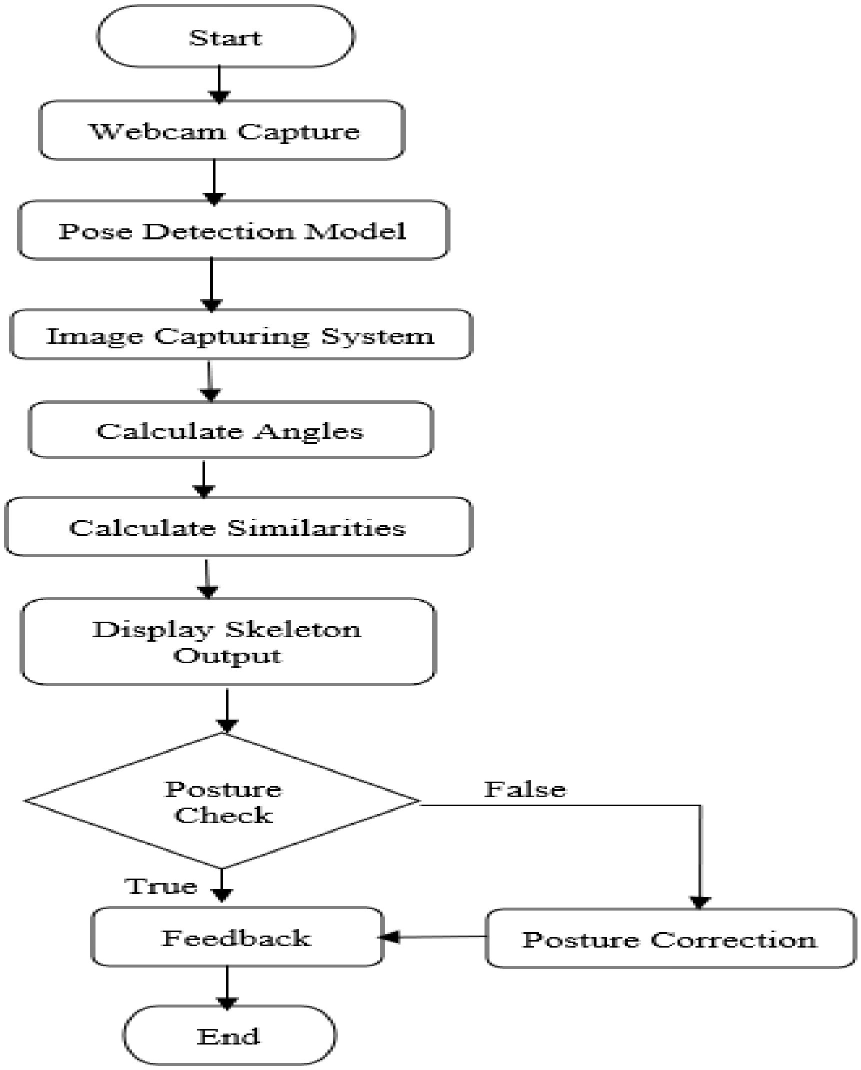



Fig3:Flowchartofwork done

Data Gathering and Annotation compileawiderangeof pictures or videos showing people in different yoga positions. Add key points to the dataset that correspond to important joints or body parts—such as the wrists, elbows, shoulders,hips,knees,andankles—thatarepertinenttoeach yoga posture.Preparing data is used to preparetheannotated dataforYOLOv8 model training, extract key points from the data and format them properly. To guarantee uniformity across the collection,resizephotosorvideo frames to aconsistentsize and normalize key points.

Training Models use of learnt features, start the YOLOv8modelwithpre-trainedweightsonalargedataset,like COCO. Use transfer learning to fine-tune the model on the annotated yoga posture dataset, modifying weights to identify yoga postures based on key points.

Toextractidentifiedkeypointsandtheir related locations in each picture or video frame, process the YOLOv8 model's output. To accurately recognize yoga poses, remove noisy or incorrect key points and adjust their placements.

To identify the yoga postures that people are doing in the picture or video frames, use the key points that have been recognized. To categorize and identify the executed postures, compare the key point positions with a database of recognized yoga poses.Correcting Posture, in the event that the identified yoga postures require enhancement or modification, provide practitioners advice or comments based on the identified essential elements. Put guidelines or directions across the picture or video frames to assist people in repositioning themselves for optimal alignment.

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*B. System Architecture*

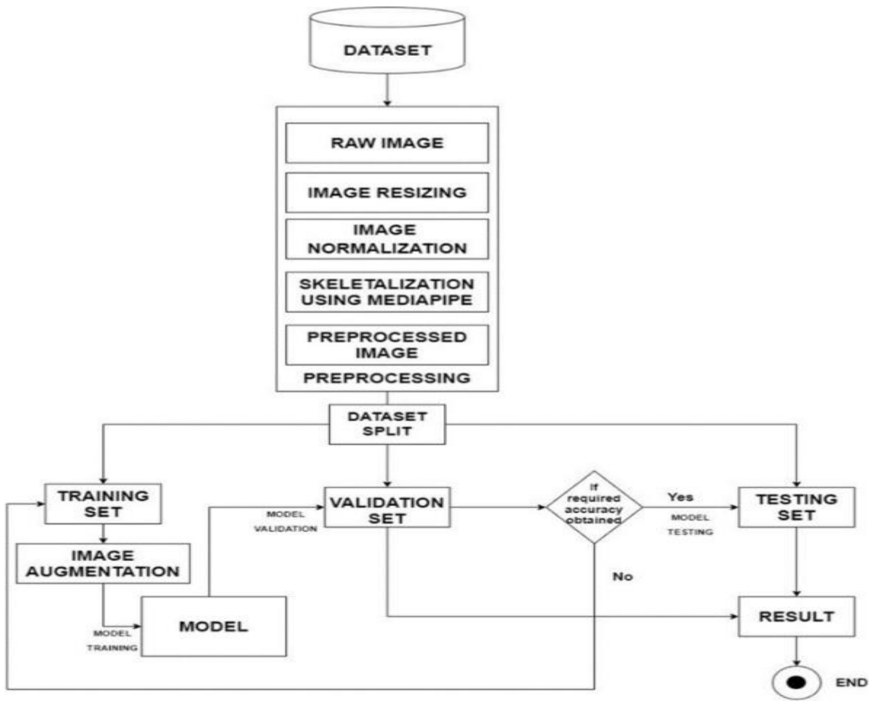


Fig4.SystemArchitecture

Thesize,source,andotherpertinent information aboutthedatasetutilizedinthestudyaredescribedinsection. Raw Image describes the initial, raw photos that were taken from the dataset, emphasizing any necessary preparatory steps like scaling or normalization. ImageResizing describeshowtherawphotosareresized to a standard dimension to provide consistency and computational efficiency throughout processing. Imagenormalizingtalksabouthownormalizingisused to improve model convergence and performance by scaling down pixel values to a uniform range.Skeletalization with Media Pipe overview of the techniqueusedisgiven,withafocusonhowithelpsextract structuralinformation orimportantelements fromthe photos. It may be implemented using the Media Pipe library.Preprocessed Image shows the image after it has been resized, normalized, and skeletonized, highlighting the changes made to get the data ready for analysis.Preprocessing describes the preprocessing pipeline in detail,includingtheparticularactionsusedtogetthepictures ready for further examination or model training. TrainingSet describesthesizeandmakeupofthedataset subset that is meant to be used for model training.

## V. RESULT

*1) Interface*


Fig 5. User Interface

2) *Final Result:*

- Using Image

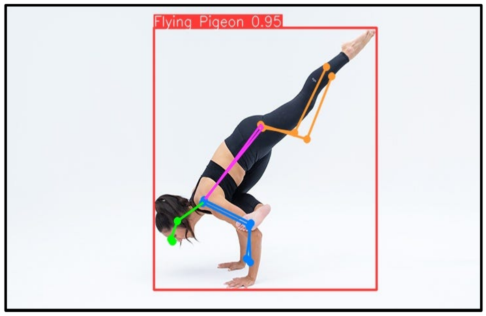


Fig 6. Pose Detection 1


Fig 7. Pose Detection 2

- Using Webcam

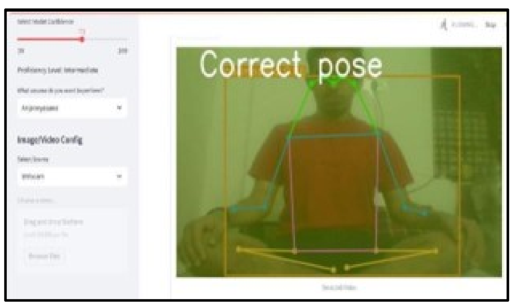


Fig 8. Correct Pose Detection


Fig 9. Incorrect Pose Detection

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Fig 10. Correct Pose Detection

## VI. CONCLUSION

Tosumup,theuseofYOLOv8forestimatingyogaposesis anoteworthydevelopmentincomputervisionmethods utilized in the yoga analysisdomain. YOLOv8'sreal-time performanceallowsforeasyintegrationintoavarietyof apps,givingpractitioner sinstantfeedback whiletheypractice yoga. With the ability to modify and perfectpositionsinrealtime,thisfeatureispricelessfor augmentingthelearning process.

Furthermore, YOLOv8's high degree of precision in identifyingandlocalizingyogapositionsguaranteesaccurate feedbackon thealignmentandexecutionoftheposes.Yoga practitioners may improve their technique and prevent injuries by using YOLOv8 to assist extensive study of postures by properly identifying important body joints and landmarks. Moreover, YOLOv8's computational efficiency makes it appropriate for implementation on devices with limited resources, including wearables and smartphones fitness monitors. This increases the technology's accessibility for estimating yoga poses, making itpossible fora largergroup of users to gain from tailored advice and feedback when practicing.

It is imperative to recognize the persistent obstacles and prospectsforenhancementinYOLOv8-based yogaposition estimate. Enhancing the model's robustness and generalization abilities will need addressing variables

## REFERENCES

[1] Neha D, Dr. S. K. Manju Bargavi. "Virtual Fitness Trainer using Artificial Intelligence." Jain (Deemed-to- be University), Bangalore, India, School of CS & IT. MCA Student, Professor. 2024.

[2] Gajbhiye, R., Jarag, S., Gaikwad, P., Koparde, S. "AI Human Pose Estimation: Yoga Pose Detection and Correction." Department of Computer Engineering, Faculty of Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Pune, Maharashtra.

[3] Anusha S, Nayana Shree A, Nithin R, Pavan Prabhu N, Rahul D M. "Computer Vision Based Workout Application." Department of Computer Science and Engineering, MVJ College of Engineering, Bangalore, Karnataka, India. DOI: https://doi.org/10.55248/gengpi.4.423.37565

[4] Kotte, H., Kravčík, M., Duong-Trung, N. "Real-Time Posture Correction in Gym Exercises: A Computer Vision-Based Approach for Performance Analysis, Error Classification and Feedback." Educational Technology Lab, German Research Center for Artificial Intelligence (DFKI), Berlin, Germany.

[5] Ji, H., Githinji, K. S., Kenji, T. "AI Fitness Coach at Home using Image Recognition." University of Tokushima: Tokushima Daigaku. Research. Posted Date: September 29th, 2022. DOI: https://doi.org/10.21203/rs.3.rs-2047283/v1. License: Creative Commons Attribution 4.0 International License.

[6] Bhosale, V., Nandeshwar, P., Bale, A., Sankhe, J. "Yoga Pose Detection and Correction using Posenet and KNN." Vidyalankar Institute of Technology, Mumbai, India.

[7] Thoutam, V. A., Srivastava, A., Badal, T., Mishra, V. K., Sinha, G. R., Sakalle, A., Bhardwaj, H., Raj, M. "Yoga Pose Estimation and Feedback Generation Using Deep Learning." Computer Science Engineering Department, Bennett University, Greater Noida, India. MIIT, Mandalay, Myanmar. School of Computer Science and Engineering, Galgotias University, Greater Noida, India.

[8] Talaat, A. S. "Novel deep learning models for yoga pose estimator." Received: 20 August 2023 / Accepted: 7 November 2023. © The Author(s) 2023 OPEN.

[9] Kishore, D. M., Bindu, S., Manjunath, N. K. "Estimation of Yoga Postures Using Machine Learning Techniques." Division of Yoga and Life Sciences, Swami Vivekananda Yoga AnusandhanaSamsthana (S-VYASA), Department of Electronics and Communication Engineering, B N M Institute of Technology, Bengaluru.

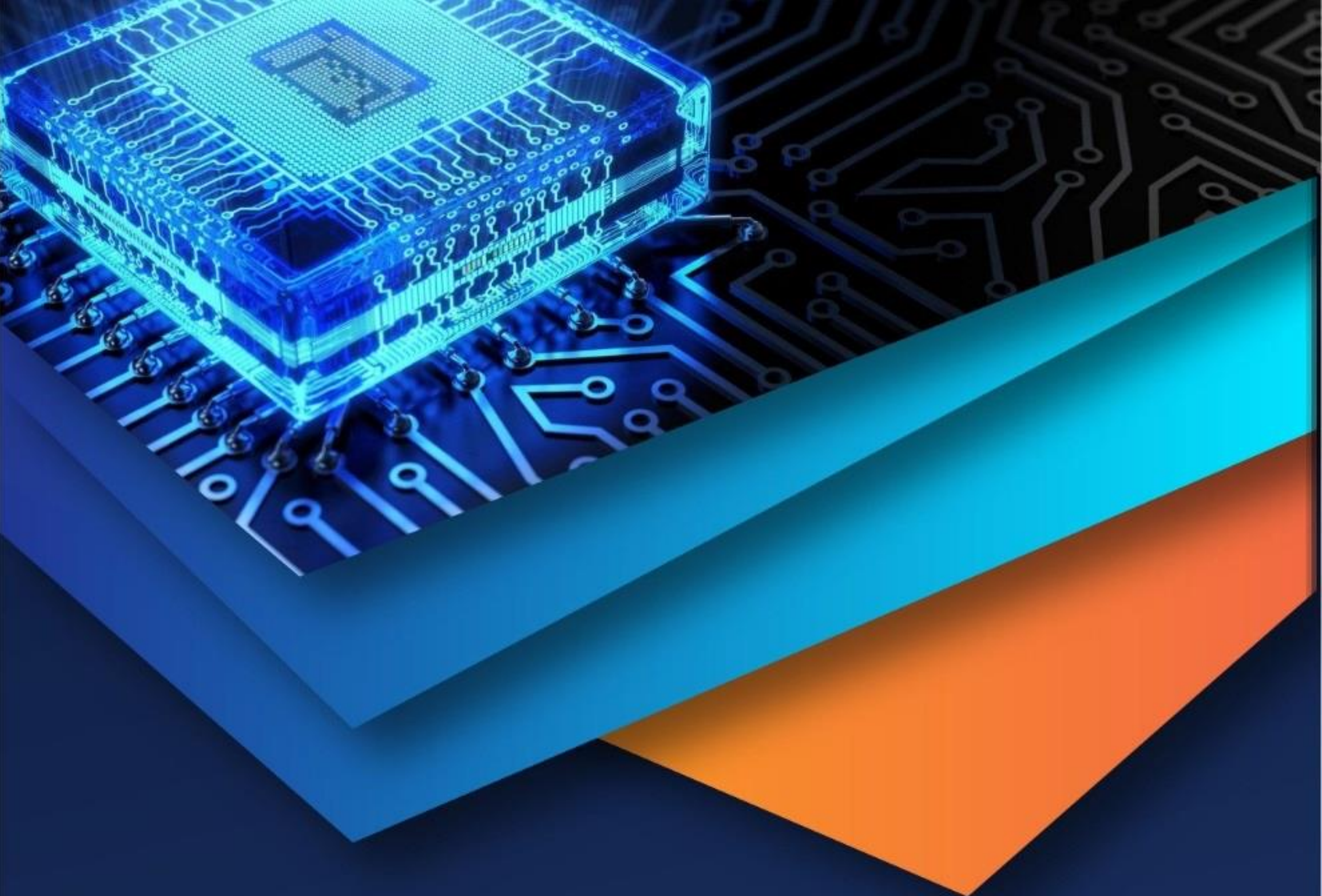
[10] P. W. Jaronde, A. Vyas and M. Gaikwad, "A Survey on Energy Aware Cognitive Radio Network," 2022 2nd International Conference on Power Electronics & IoT Applications in Renewable Energy and its Control (PARC), Mathura, India, 2022, pp. 1-6, doi: 10.1109/PARC52418.2022.9726654.

[11] D. Manikkule and P. Jaronde, "Encapsulation of Full Adder Using 180nm CNTFET," 2019 9th International Conference on Emerging Trends in Engineering and Technology - Signal and Information Processing (ICETET-SIP-19), Nagpur, India, 2019, pp. 1-6, doi: 10.1109/ICETET-SIP-1946815.2019.9092017.

[12] D. Manikkule and P. Jaronde, "Design of Decoder Using Ternary Inverter," 2019 IEEE 5th International Conference for Convergence in Technology (I2CT), Bombay, India, 2019, pp. 1-3, doi: 10.1109/I2CT45611.2019.9033760.

[13] V. Patle, S. Raut, S. Tighare, N. Thakur, P. Jaronde and R. Nakhate, "Face Mask Detection Using Machine Learning," 2023 11th International Conference on Emerging Trends in Engineering & Technology - Signal and Information Processing (ICETET - SIP), Nagpur, India, 2023, pp. 1-4, doi: 10.1109/ICETET-SIP58143.2023.10151622.

[14] A. Bavistale, A. Dhokne, A. Kukade, A. Kumbhare, A. Talokar and P. Jaronde, "Energy and Spectrum Efficient Cognitive Radio Sensor Networks," 2023 11th International Conference on Emerging Trends in Engineering & Technology - Signal and Information Processing (ICETET - SIP), Nagpur, India, 2023, pp. 1-4, doi: 10.1109/ICETET-SIP58143.2023.10151496.
[15] Jaronde, P. ., Vyas, A. ., & Gaikwad, M. . (2023). Spectrum Efficient Cognitive Radio Sensor Network for IoT with Low Energy Consumption. International Journal on Recent and Innovation Trends in Computing and Communication, 11(11s), 469–479. https://doi.org/10.17762/ijritcc.v11i11s.8176
[16] Hirudkar, Tejshri, et al. "Emotion Detection System using Deep Learning." IRFSR, IC on Big Data, Machine Learning and IoT (2022).
[17] Dahiwale, Neha, et al. "Artificial Conversational Entity (AI Chatbot)." IJCRT 8.5 (2020).
[18] Pravin Jaronde, Suraj Rebbawar, “Artificial Intelligence Based Home Automation Using Alexa”, IJACOI, Vol1, Issue2, Mar2020.
[19] Jaronde, P. W., Mangesh D. Ramteke, and Nilesh P. Bobade. "Design of Wireless Medical Monitoring System." International Journal of Engineering Research and General Science 3.2 (2015).
[20] Jaronde, P. W., Muratkar, N. A., Bhoyar, P. P., Gaikwad, S. J., &Nagrale, R. B. (2018). Review on biometric security system for newborn baby. International Journal of Scientific Research in Science and Technology, 4(2), 907–909.
[21] Bramhane, L., Salankar, S., Gaikwad, M., &Panchore, M. (2022). Impact of Work Function Engineering in Charge Plasma Based Bipolar Devices. Silicon, 14(8), 3993-3997.
[22] Bahel, Vedant, and Mahendra Gaikwad. "A Study of Light Intensity of Stars for Exoplanet Detection using Machine Learning." 2022 IEEE Region 10 Symposium (TENSYMP). IEEE, 2022.
[23] Gaikwad, Mahendra, Milind Khanapurkar, and Sachin Untawale. "Recent development of nano-satellite constellation as iot communication platform." AIP Conference Proceedings. Vol. 2424. No. 1. AIP Publishing LLC, 2022.
[24] Bahel, Vedant, and Mahendra Gaikwad. "A Study of Light Intensity of Stars for Exoplanet Detection using Machine Learning." 2022 IEEE Region 10 Symposium (TENSYMP). IEEE, 2022.
[25] Gaikwad, Mahendra, Milind Khanapurkar, and Sachin Untawale. "Recent development of nano-satellite constellation as iot communication platform." AIP Conference Proceedings. Vol. 2424. No. 1. AIP Publishing LLC, 2022.
[26] Bahel, Vedant, et al. "Supervised Classification for Analysis and Detection of Potentially Hazardous Asteroid." 2021 International Conference on Computational Intelligence and Computing Applications (ICCICA). IEEE, 2021.
[27] S. Choudhary, K. Kalbande and N. Dhote, "IoT based Multi-point Pesticide Spraying Machine," 2021 6th International Conference on Inventive Computation Technologies (ICICT), Coimbatore, India, 2021, pp. 432-436, doi: 10.1109/ICICT50816.2021.9358585.
[28] K. Kalbande, S. Choudhary, A. Singru, I. Mukherjee and P. Bakshi, "Multi-Way Controlled Feedback Oriented Smart System for Agricultural Application using Internet of Things," 2021 5th International Conference on Trends in Electronics and Informatics (ICOEI), Tirunelveli, India, 2021, pp. 96-101, doi: 10.1109/ICOEI51242.2021.9452946.
[29] P. Kolhe, A. Baseshankar, M. Murekar, S. Sadhankar, K. Kalbande and A. Deshmukh, "Smart Communication System for Agriculture," 2022 Third International Conference on Intelligent Computing Instrumentation and Control Technologies (ICICICT), Kannur, India, 2022, pp. 1122-1126, doi: 10.1109/ICICICT54557.2022.9917715.
[30] V. Kanhekar, T. Deshbhratar, Y. Matey, K. Kalbande and A. Deshmukh, "Hydroponic Farming using IoT," 2022 International Conference on Edge Computing and Applications (ICECAA), Tamilnadu, India, 2022, pp. 583-586, doi: 10.1109/ICECAA55415.2022.9936366.
[31] P. Kolhe, K. Kalbande and A. Deshmukh, "Internet of Thing and Machine Learning Approach for Agricultural Application: A Review," 2022 10th International Conference on Emerging Trends in Engineering and Technology - Signal and Information Processing (ICETET-SIP-22), Nagpur, India, 2022, pp. 1-6, doi: 10.1109/ICETET-SIP-2254415.2022.9791751.
[32] Jaronde, Pravin, Archana Vyas, and Mahendra Gaikwad. "Encapsulation of Energy Efficient, Clustering Algorithm and Spectrum Sensing for Cognitive Radio Based Internet of Things Networks." Journal of Electrical Systems20.5s (2024): 2570-2578.

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